Multi-Sensor Satellite Time-Series for River and Estuarine Monitoring
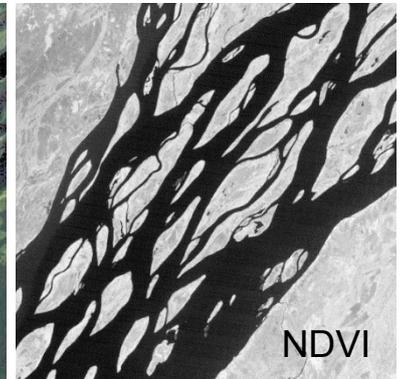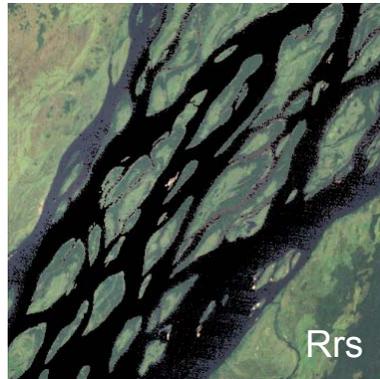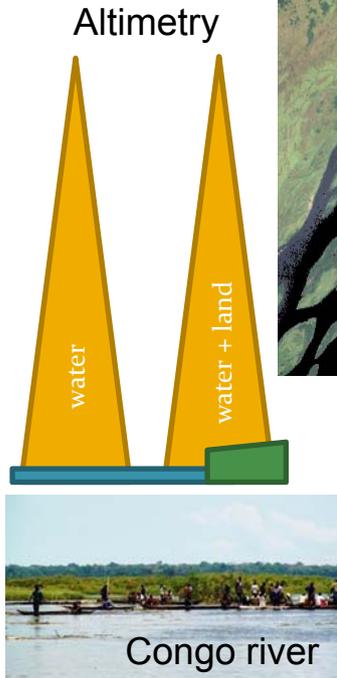
Pixalytics **Pixalytics**

Samantha Lavender

(1) Pixalytics Ltd, Plymouth, UK. (slavender@pixalytics.com)

INTRODUCTION

Satellite altimetry utilises pulses of microwave energy, with the strength and origin of the reflections providing an average surface height unaffected by cloud cover.
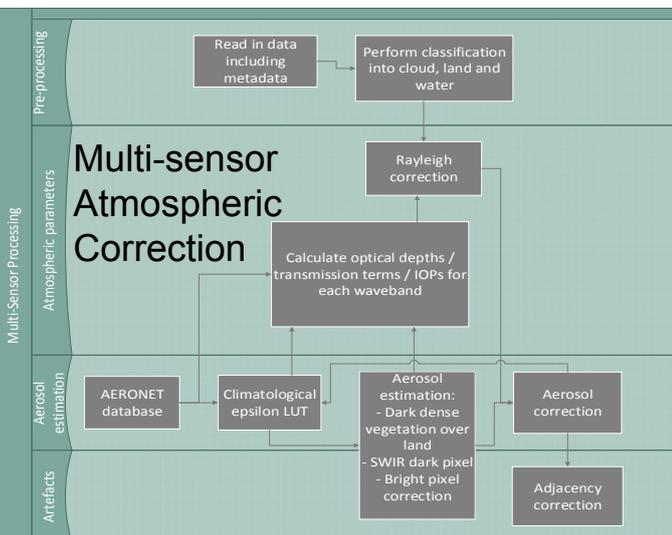
However, to construct a river / estuarine water level time-series there needs to be careful data editing and filtering to ensure that only waveforms are selected where the leading edge is over the water and so height can be determined accurately.

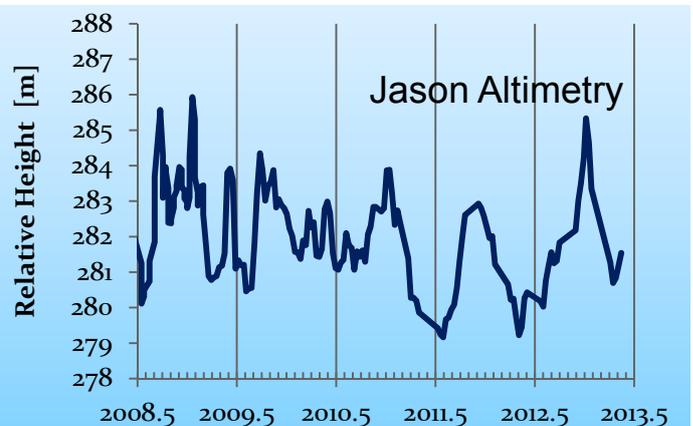Altimetry

water

water + land

Congo river

Rrs

NDVI

Approach

Focused on creating an accurate and up-to-date inland water location mask using Landsat Multi Spectral Scanner (MSS), Thematic Mapper (TM), Enhanced Thematic Mapper (ETM) and Operational Land Imager (OLI) data; allows short segments of above water altimetry data to be selected.

Having a frequently acquired mask is important when the area under investigation is dominated by shallow and/or tidal waters where the land/water interface varies significantly in location. At present, the Landsat dataset alone isn't providing sufficient temporal coverage due to both acquisition and cloud cover constraints.

Therefore, updates will include the addition of data from a broader range of medium resolutions sensors (both microwave and optical) to create a more complete water extent time-series. In the future, we also foresee using Sentinel-2 Multispectral Instrument (MSI) data as a complementary dataset.

Landsat processing

The Landsat data processing starts with the conversion to radiance using the supplied radiometric calibration information (held in the MTL file) and then conversion to planetary reflectance using the extraterrestrial solar irradiance and solar zenith angle, followed by atmospheric correction to give the surface reflectance .

The infrared wavelengths are strongly influenced by water absorption, which often gives water bodies a distinctive low spectral response, while active terrestrial vegetation strongly absorbs red light and reflects near-infrared (NIR) light and soil has stronger reflectance in the NIR compared to red.

Jason Altimetry

(Plot: Relative Height [m] vs time, y-axis 278–288, x-axis 2008.5–2013.5)

Pre-processing

Read in data including metadata → Perform classification into cloud, land and water

Multi-Sensor Processing

Multi-sensor Atmospheric Correction

Rayleigh correction

Calculate optical depths / transmission terms / IOPs for each waveband

Aerosol estimation

AERONET database → Climatological epsilon LUT → Aerosol estimation:
- Dark dense vegetation over land
- SWIR dark pixel
- Bright pixel correction

Aerosol correction

Artefacts

Adjacency correction